

*COFC*

Atty. Docket No.: 2846/2102

PATENT

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of: Michael J. Naughton

Examiner: Arana, Louis M.

Patent No.: 6,887,365 *B2*

Issued: May 3, 2005

Group Art Unit: 2859

Entitled: Nanotube Cantilever Probes for  
Nanoscale Magnetic Microscopy

Serial No.: 10/665,800

Conf. No.: 6142

Filed: September 18, 2003

**CERTIFICATE OF MAILING UNDER 37 C.F.R. § 1.8a**

I hereby certify that this correspondence (and any paper or fee referred to as being enclosed) is being deposited with the United States Post Office as First Class Mail on the date indicated above in an envelope addressed to Mail Stop: Certificate of Correction, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450

David J. Dykeman

Name of Person Mailing Paper

Signature of Person Mailing Paper

**Mail Stop Certificate of Correction****Commissioner for Patents****P.O. Box 1450****Alexandria, VA 22313-1450****Certificate**  
**MAY 18 2005****TRANSMITTAL LETTER****of Correction**

Enclosed for filing the above-identified patent application, please find the following documents:

1. Request for Certificate of Correction;
2. Copy of Amendment and Reply filed with the USPTO on November 19, 2004;  
and
3. Return Postcard.

The Commissioner for Patents is hereby authorized to charge any fees to Deposit Account No. 16-0085, Reference 2846/2102. A duplicate of this transmittal letter is enclosed for this purpose.

Respectfully submitted,

  
Name: David J. Dykeman  
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MAY 23 2005

Date: May 12, 2005



Atty. Docket No.: 2846/2102 PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

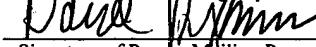
Application of:	Michael J. Naughton	Examiner:	Arana, Louis M.
Patent No.:	6,887,365 B2	Group Art Unit:	2859
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Alexandria, VA 22313-1450

**REQUEST FOR CERTIFICATE OF CORRECTION**

Sir:

Applicants request issuance of a Certificate of Correction for U.S. Patent No. 6,887,365.

Applicants have identified 3 typographical errors in claims 4, 5 and 14 that require correction:

1. Claim 4, the "a" after "comprises" should be deleted, so it reads "comprises tubules", NOT "comprises a tubules".
2. Claim 5, the "a" after "comprises" should be deleted, so it reads "comprises tubules", NOT "comprises a tubules".
3. Claim 14, should read "micro-dimensional probe" NOT "micro-dimensional robe".

The Amendment and Reply filed with the United States Patent and Trademark Office on November 19, 2004 (copy enclosed) correctly lists claims 4 (formerly claim 8), claim 5 (formerly claim 9) and claim 14 (formerly claim 15). Please correct claims 4, 5 and 14 in the issued patent.

As this correction is necessitated by an error on the part of the Patent Office, no fee is due on the part of Applicants.

**Corrections to the Claims** are shown in the "Listing of Claims" which begins on page 2 of this paper.

**CORRECTIONS TO THE CLAIMS**

The following Listing of the Claims 4, 5 and 14 is based on the Amendment and Reply filed November 19, 2004. A marked up listing of the claims follows:

**CLEAN LISTING OF THE CLAIMS 4, 5 and 14:**

4. The micro-dimensional probe of claim 3, wherein the Y-shaped or V-shaped morphology comprises tubules having a length ranging between 0.1 micrometer and 100 micrometers.
5. The micro-dimensional probe of claim 3, wherein the Y-shaped or V-shaped morphology comprises tubules having a length ranging between 1 micrometer and 10 micrometers.
14. The micro-dimensional probe of claim 13, that provides detection with nanoscale resolution.

**MARKED-UP LISTING OF CLAIMS 4, 5 and 14:**

4. The micro-dimensional probe of claim 3, wherein the Y-shaped or V-shaped morphology comprises [a] tubules having a length ranging between 0.1 micrometer and 100 micrometers.
5. The micro-dimensional probe of claim 3, wherein the Y-shaped or V-shaped morphology comprises [a] tubules having a length ranging between 1 micrometer and 10 micrometers.
14. The micro-dimensional ~~robe~~ probe of claim 13, that provides detection with nanoscale resolution.

Patent No. 6,887,365  
Request for Certificate of Correction  
Page 3

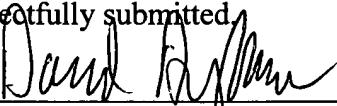
As this correction is necessitated by an error on the part of the Patent Office, Applicants believe no fee is due.

Applicants respectfully request a correction of the patent in your proper manner and issuance of a Certificate of Correction.

Please contact the undersigned Attorney of record with any questions.

Respectfully submitted,

Date: May 12, 2005

  
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MAY 23 2005



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Atty. Docket No.: 2846/2102

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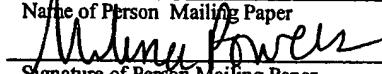
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of: Michael J. Naughton  
Serial No.: 10/665,800  
Filed: September 18, 2003  
Titled: Nanotube Cantilever Probes for  
Nanoscale Magnetic Microscopy

Examiner: Louis M. Arana  
Group Art Unit: 2859  
Conf. No.: 6142

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Melissa Powers  
Name of Person Mailing Paper  
  
Signature of Person Mailing Paper

Mail Stop Amendment  
Commissioner for Patents  
P.O. Box 1450  
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AMENDMENT AND REPLY

Sir:

This Amendment is being filed in response to the Office Action mailed from the U.S. Patent and Trademark Office on August 19, 2004 in the above-identified application. Reconsideration and further examination are requested.

**Amendments to the Specification** begin on page 2 of this paper.

**Amendments to the Claims** are shown in the "Listing of the Claims" which begins on page 3 of this paper.

**Remarks** begin on page 6 of this paper.

Please enter the following amendments and remarks.

Amendments to the Specification:

Please replace the paragraph at page 12, from line 23 through line 29, with the following paragraph:

-- Figure 7 4b shows an AFM image of tungsten wires on silicon-nitride on a silicon wafer surface. The bumps visible at the ends of each wire are nickel nanodots situated to serve as catalyst sites for subsequent growth of CNTs. Referring to Figures 4a and 4b, closely spaced nanotubes can be brought into contact electrostatically, and then attaching, by for example electroless deposition, a ferromagnetic nanoparticle to their juncture. The resulting V-shaped device can then be excited electromagnetically (Lorentz force) into mechanical resonance, for MRFM detection. --

The following Listing of the Claims will replace all prior versions and all prior listings of the claims in the present application:

1. (Currently Amended): A micro-dimensional probe comprising:
  - a) an electrode pair array attached to a substrate material;
  - b) a branched nanotube cantilever comprising: array configured in a cantilever arrangement comprising a plurality of microparticulate ferromagnetic materials attached to the electrode array; and
    - i) at least one ferromagnetic material; and
    - ii) at least two tubules attached to the electrode pair; and
  - c) an electrical circuit coupling the electrode pair array to a probe component.
2. (Currently Amended): The micro-dimensional probe of claim 1, wherein the branched nanotube cantilever exhibits piezoresistance.

Claim 3 cancelled.

4. (Currently Amended): The micro-dimensional probe of claim 3 1, wherein the branched carbon nanotube cantilever comprises at least one tubule with has a Y-shaped or V-shaped morphology.
5. (Currently Amended): The micro-dimensional probe of claim 3 1, wherein the branched carbon nanotube cantilever has a multi-walled morphology.
6. (Currently Amended): The micro-dimensional probe of claim 4 1, wherein the tubules have has a diameter ranging between 1 nanometer and 100 nanometers.
7. (Currently Amended): The micro-dimensional probe of claim 4 1, wherein the tubules have has a diameter ranging between 1 nanometer and 50 nanometers.

8. (Currently Amended): The micro-dimensional probe of claim 4, wherein the Y-shaped or V-shaped morphology comprises a tubules having a length ranging between 0.1 micrometer and 100 micrometers.
9. (Currently Amended): The micro-dimensional probe of claim 4, wherein the Y-shaped or V-shaped morphology comprises a tubules having a length ranging between 1 micrometer and 10 micrometers.
10. (Original): The micro-dimensional probe of claim 1, wherein the ferromagnetic material comprises at least one transition metal.
11. (Original): The micro-dimensional probe of claim 10, wherein the transition metal is selected form the group consisting of iron, cobalt, nickel and combinations and alloys thereof.
12. (Original): The micro-dimensional probe of claim 1, that is part of a microscopic imaging device.
13. (Original): The micro-dimensional probe of claim 12, having a nanoscale dimension.
14. (Original): The micro-dimensional probe of claim 13, wherein the microscopic imaging device is an MFM or MRFM device.
15. (Original): The micro-dimensional probe of claim 14, that provides detection with nanoscale resolution.

Claims 16-43 cancelled.

44. (Original): A method of sensing or manipulating a microscopic environment or structure using the micro-dimensional probe of claim 1, comprising:
  - a) passage of an electric current through the micro-dimensional probe; and

b) detecting a cantilever tip motion generated by the electric current passage through the micro-dimensional probe by measuring a change in piezoresistance upon deflection from the surface of a sample.

45. (New): The micro-dimensional probe of claim 1 comprising a plurality of branched carbon nanotube cantilevers arranged in an array.

46. (New): The microdimensional probe of claim 1 wherein the branched nanotube cantilever is a branched carbon nanotube cantilever.

47. (New): The microdimensional probe of claim 1 wherein the ferromagnetic is a material is a magnetic sensor material.

## REMARKS

Claims 1, 2, 4-15, 44 and 45 are currently pending in the application. Claims 3 and 16-43 are canceled. Claims 1, 2 and 4-9 have been amended. Claims 45-47 have been added. The amendments find support in the specification and are discussed in the relevant sections below. No new matter is added.

### **I. Amendments to the Specification**

The paragraph at page 12, from line 23 through line 29, describing Figure 4b, is amended to clarify the correct Figure number. Support for the amendment is found at least at page 7, from line 23 through line 24. No new matter is added.

### **II. Amendment to the Claims**

With this amendment, Applicant has amended independent claim 1. Amended independent claim 1 now recites “an electrode pair attached to a substrate material” and “a branched carbon nanotube cantilever comprising: at least one ferromagnetic material and at least two tubules attached to the electrode pair”. Thus, amended independent claim 1 now contains allowable subject matter. Applicants have also amended dependent claims 2 and 4-9 to correct minor errors and more clearly define the invention. No new matter is added with any of the amendments. Support for the amendments herein is found throughout the Applicants’ specification as filed in at least the following passages: page 5, line 26 through page 6, line 9; page 10, lines 25-29; page 14, lines 2-6; page 15, lines 15-18; page 15, lines 19-21 and Figures 1-3.

### **III. Claim Rejection Under 35 U.S.C. § 102(e)**

Claims 1-15 and 44 are rejected under 35 U.S.C. §102(e) as being anticipated by Lee et al. (U.S. Patent No. 6,755,956).

The Office Action states that “Lee discloses a probe (see Fig. 6b) having a substrate 31, on which are formed catalyst dots 33 having attached thereon an array of nanotubes 35. The nanotubes are in a cantilever arrangement and the catalyst dots may be a ferromagnetic material as described in line 54 of col. 6. Note further that the array as described for example, under

EXAMPLE II are envisioned for use in scanning probe microscopy.” Applicant respectfully requests reconsideration and withdrawal of the rejection.

*Response*

Applicant has amended claim 1 to recite a micro-dimensional probe comprising “an electrode pair” attached to a substrate material” and “a branched carbon nanotube cantilever comprising: at least one ferromagnetic material and at least two tubules attached to the electrode pair”. As amended, Applicants’ claimed invention does not read on such as disclosed by Lee et al. Lee et al. does NOT disclose Applicants’ claimed probe. Lee et al. discloses a method of growing a linear carbon nanostructure. The carbon nanostructure disclosed in Lee et al. are linear carbon nanostructures (as shown in FIGS. 4, 6b, 7, 8b and 10), i.e., they do NOT contain a branched carbon nanotube cantilever comprising: at least one ferromagnetic material and at least two tubules attached to the electrode pair. Applicant respectfully requests reconsideration and withdrawal of the rejection.

Applicant submits that all claims are allowable as written and respectfully request early favorable action by the Examiner. If the Examiner believes that a telephone conversation with Applicant's attorney/agent would expedite prosecution of this application, the Examiner is cordially invited to call the undersigned attorney/agent of record.

Respectfully submitted,



Date: November 19, 2004

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